

Lyons-Knight

1914 CARS

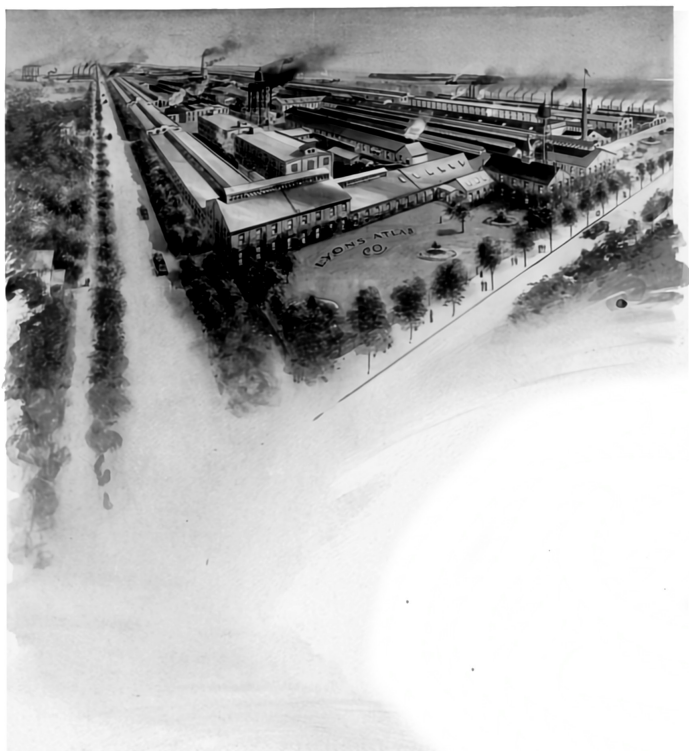


Lyons-Knight

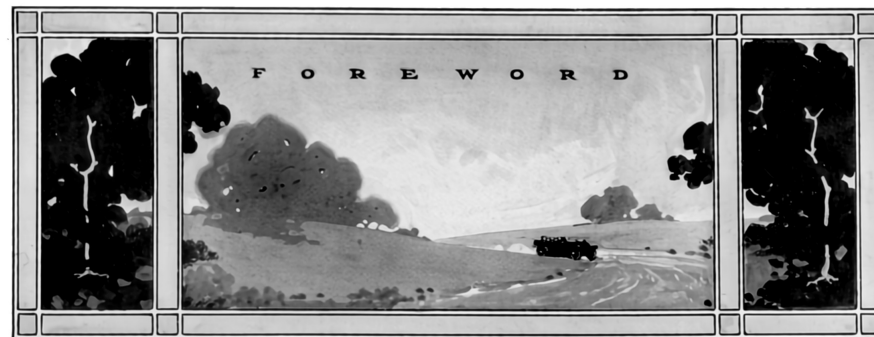
CARS



LYONS ATLAS COMPANY
INDIANAPOLIS, IND.



*Works of the Lyons Atlas Company
Manufacturers of Lyons-Knight Cars*



The Lyons Atlas Company is abundantly supplied with all the elements necessary to make a great and permanent success of Lyons-Knight cars. The elements are:

- An immense plant capable of producing fifty thousand cars a year.*
- Unlimited capital to manufacture this number of cars each year.*
- Ideal railroad connections for prompt shipment of cars.*
- The best city and location in the world for making motor cars.*
- The greatest engine and the finest car to match the great engine.*
- A silent car, giving a new delight to motoring.*
- An organization of competent, experienced and determined men.*
- A policy honest, just and liberal to all.*

The works of the Lyons Atlas Company include over sixty-five acres of ground, together with six hundred and twenty-seven thousand square feet of floor space, having its own foundries, machine shops, drop forge and die-cast plants and numerous other departments which make it, to a great extent, independent of outside supply.

There are more than six miles of railroad tracks in the buildings and grounds, and it has direct rail connections with all the many railroads running into the city, and the company has its own locomotives and cars for yard switching.

The Lyons plant is centrally located in the best automobile manufacturing city in the world, and within a few miles of the center of population of the United States. For many years it has been the best-known and largest manufacturing plant of the city.

This company has the very strongest possible financial backing, which gives it ample capital to manufacture as large a number of cars as it desires without having to resort to the customary practice of trying to sell stocks and bonds to the public at frequent intervals.



This means the rare and permanent ability on the company's part to give the maximum service and security to all its customers and agents, so necessary and desirable.

The president, Mr. James W. Lyons, is a very active and able man of large experience, accustomed to making permanent successes of his undertakings. He has had twenty-five years' experience in responsible charge of manufacturing and engineering work of the highest grade, including the designing and construction of some of the largest and most important manufacturing plants in this country and Europe, and also as president and general manager of several manufacturing companies in which he has been and is now interested.

The manager of the automobile department is Mr. Harry A. Knox, who is one of the pioneers of the automobile industry and founder of the Knox Automobile Company of Springfield, Mass. He has had a very wide and thorough experience in all branches of the motor car industry during its entire life.

A corps of expert, experienced automobile engineers for designing and consultation is maintained at all times, and the whole organization is made up of carefully selected men who are acknowledged experts and specialists in their various departments.

This company has for years built steam engines; also large quantities of automobile engines and transmissions for many prominent car builders, and was the originator in America of strictly interchangeable parts. Parts can be bought from us to-day to fit any machine made in this plant during the last forty years.

This company owns and controls one of the very few American licenses issued for the famous Knight engine. This license allows it to manufacture unlimited quantities of improved Lyons-Knight engines for pleasure cars; also for all kinds of commercial cars; also Knight engines for other motor car companies.

This company has one great advantage over the older automobile companies. It has no car parts of previous models to use up. Therefore, Lyons-Knight cars embody the very latest and most desirable features that have been perfected and adopted by progressive and foreign car builders.

The older companies are greatly handicapped and prevented to a great extent from adopting these new and desirable features, as there would be a tremendous financial loss and delay in discarding the parts, tools and fixtures of previous models.



GENEROUS SIZE, SUBSTANTIAL WEIGHT AND STRENGTH

The aim has been to build these cars so that they will have an abundance of room everywhere inside of the body, as many cars are now being used during the cold weather, when the passengers are thickly clothed and need more space.

Both the front and rear seats are extra wide, with ample room in front of them. This gives the maximum amount of comfort to even the largest people. There is ample room between the front and rear seats, so that one or two suitcases can easily be carried there when four or five people are touring.

The sides of the car, including the top of the doors, are high. The principal use of the four doors is to keep out mud, dust and wind, and, with the high sides, the maximum benefit is obtained. These desirable, roomy bodies naturally mean additional weight.

The four large tires and wheels, in addition to the extra ones carried, also mean considerable additional weight, but any one who has ridden much on both small and large tires appreciates and will acknowledge the very great increase in comfort and in easy, smooth riding on large tires.

A light car will tend to skid and even cause fatal accidents when striking ruts and electric car tracks, or when brakes are applied suddenly, or when the front wheel strikes soft ground, while the weight and momentum of the heavier car tends to carry it straight and prevent trouble and disaster. When a car has ample weight it absorbs much of the road vibration that a lighter car transmits to the passengers.

Most of the serious accidents to automobiles are with light cars, because an object of light weight is much easier deflected from its course than one with more weight.

In order to lighten cars the margin of safety is often reduced to the danger point. This is the reason why breakages of running parts, frames, axles, etc., are much more frequent in the light cars. If 25 per cent. additional weight is properly added to a car it gives it 100 per cent. additional strength. Ample strength and large bearing surfaces, which tend to a long life and the maximum amount of safety, have not been sacrificed in order to save weight in the Lyons-Knight cars.

Passengers appear to the best advantage in a large, substantial car, especially in the Lyons-Knight, as dignity, character and usefulness have been perfectly blended without going to extremes in any detail.

The Lyons-Knight car will be advertised and known as "The Car of Silence". It combines the silent Knight engine, silent worm gear drive and silent transmission in the rear axle case, silent electric starter, silent chains for operating the engine sleeves, pump, magneto, fan and starter, and silent bearings throughout the engine and chassis.

Noise means excessive friction and wear and is directly responsible for nine-tenths of the fatigue experienced in motoring. All mechanical noises have been entirely eliminated in the Lyons-Knight—the quietest car built.

This company has permanently entered the great automobile industry, believing that the unusual merit of its product, and prices, combined with a just and liberal policy to all, will be appreciated and recognized by the automobile public.



THE KNIGHT ENGINE

THE performance of the Knight car in the great International Five-Hundred-Mile Race, at Indianapolis, May 30th, 1913, was by far the most remarkable of any of the twenty-seven competing cars. It won fifth place, made a less number of stops and used less gasoline than any of the contestants. It had no engine trouble of any kind, and all acknowledged it was the quietest and smoothest-running car on the track during the entire race. The most important fact, however, was that this great showing was made with much the smallest engine in any of the cars, the Knight engine used being a four-cylinder $3\frac{1}{8}$ -in. bore, A.L.A.M. rating, 17 H.P., with only 250 cubic inches displacement, against 448 cubic inches displacement of the engine in the winning car.

This company has adopted the Knight engine after the most thorough investigation of its merits and achievements. The further improvement of poppet valve engines has met an insurmountable barrier in the limitations and objectionable features of the poppet valve mechanism. The Knight sliding valve solves the problem, and it is rapidly assuming command in the automobile field.

The essential difference between the Knight engine and all other four-cycle engines is the method of admitting the explosive charge and expelling the burnt gases from the cylinder.

This is accomplished in the Knight engine by using silent sliding sleeve valves, positively and smoothly operated by eccentrics, instead of the noisy, clapping, pounding poppet valves violently opened by cams and violently closed by springs.

This irregular and violent action of poppet valves invariably pound and abuse their seats, causing leakage and waste of power.

In the Knight engine the inlet and exhaust ports of the cylinder are opened and closed by the action of two cylindrical sleeves which slide one within the other between the piston and the inside wall of the cylinder.

Each sleeve is connected by a small connecting-rod to the eccentric shaft, which rotates at one-half engine speed. The eccentric rods move the sleeves up and down $1\frac{1}{4}$ inches, the sleeves making one stroke while the piston is making two strokes.

At the time of explosion, both sleeves are at the top of the stroke, and the ports in the sleeves are above the rings on the cylinder head, thereby hermetically sealing up the combustion chamber and insuring that every ounce of power will be delivered to the piston and that no compression can escape through the intake and exhaust ports.



At the end of the power stroke, the exhaust port in each sleeve register with each other and with the exhaust port of the cylinder, letting out the burnt gases throughout the entire exhaust stroke. At the end of the exhaust stroke the intake port in each sleeve register with each other and with the intake port of the cylinder.

As the piston descends, it pulls a fresh charge through these inlet ports into the combustion chamber. When the piston rises again on the compression stroke the action of the sleeves closes all the ports, allowing the charge to be compressed and then ignited at the proper time.

The Knight valve action greatly reduces the internal resistance of the engine and gives it perfect conservation of power, due to the much larger, more direct and quicker acting inlet and exhaust ports. The ports in the sleeves are never subjected to the high combustion pressure and temperature as the poppet valves are.

The increased size and quickness of opening of the ports of the Knight engine enables the new charge to be drawn into the combustion chamber with a minimum back-pull on the piston, which saves power. It also enables the burnt gases to be forced out with the minimum back pressure on piston, which again saves power.

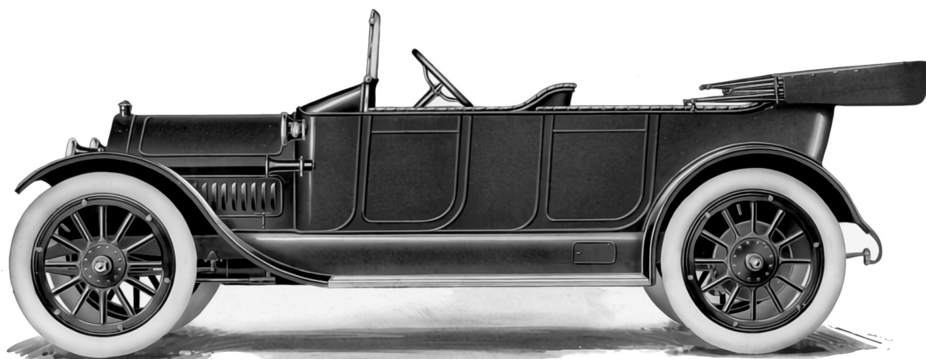
The action of the incoming charge is so direct and has so little contact with the port surface that it does not get overheated and expand, and reduce the charge, which does happen to the charge of the poppet-valve engine.

The quick and positive way the gas is admitted to and expelled from the cylinders; also the spherical shape of the combustion chamber allows a wide and rapid variation of engine speed, producing a flexibility and smoothness of running almost equal to that of the steam engine.

The distribution of gas to each cylinder and its compression are absolutely equal, and the piston and sleeves are perfectly balanced, therefore at all speeds the Knight runs with the least vibration, and with a smoothness that is remarkable, a four-cylinder Knight equaling a six-cylinder poppet-valve engine.

In the Knight engine, all the non-troublesome parts, as pistons, crank shaft, connecting-rods and crank cases, are very similar to those of the best type of poppet-valve engines. All of the trouble-giving parts of the poppet-valve engines, are however, conspicuous by their absence.

The poppet valves, which rapidly wear, clog with carbon, leak, stick and break, are absent. There are no cams with their noisy, knocking action, no springs to break or weaken, which causes the noisy, destructive and uncertain closing of poppet valves.



Lyons-Knight Five-Passenger Touring Car—\$2900

There is never any valve grinding necessary and no reseating of valves; valve-timing is unnecessary, as the opening and closing of the intake and exhaust ports are positive and non-adjustable.

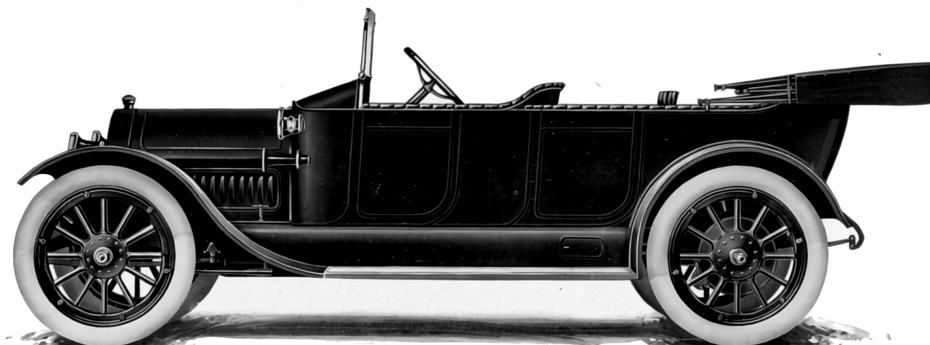
In poppet-valve engines the setting of the valve varies with the wear of the cams and push rods; and their closing is varied by the springs weakening.

The combustion chamber is spherical in shape which at last realizes what has been the ambition of gas engine designers for many years. The round combustion chamber exposes less wall surface to absorb the heat, pressure and power from the charge. It also concentrates the charge which makes it burn quicker, therefore giving a more powerful explosion and a more complete scavenging of the burnt gases from the cylinder. It limits the heat lost through the walls of the combustion chamber to a minimum and converts this saving into much added power.

A larger, quicker and more direct intake and exhaust, the spherical combustion chamber and conservation of compression and pressure, enable the Knight to give more power with less fuel than any other type of automobile engine.

The absence of all mechanical noises from the Knight type of engine is due to the silent, sliding action of the sleeve valves instead of the noisy, violent pounding and clapping action of the poppet valves. Furthermore, there is so much surface to the Knight sleeves and their action and work so slight they will run for years without perceptible wear. This makes the engine permanently silent, from which it derives its deservedly appropriate name—"Silent Knight".

The poppet valve at any but the lowest speeds is always noisy, due to its



Lyons-Knight Seven-Passenger Touring Car—\$2980

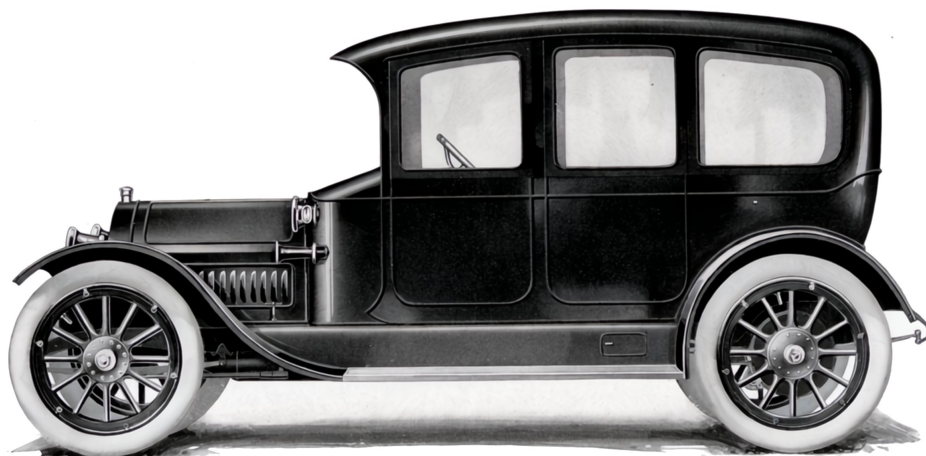
clapping action, and as the wear on their seats and stems is very great, looseness and noise steadily increase with use.

When the makers of such world-famous cars as the Daimler of England, Mercedes of Germany, Panhard and Mors of France, Minerva of Belgium, together with a large number of other progressive European companies, have to a great extent entirely abandoned the poppet-valve engine after years spent in developing it to the highest possible point, it surely indicates one thing—that the final results with the poppet-valve engine were deficient and unsatisfactory and that the Knight engine was a great improvement and a necessity when the best was wanted.

This change would not have been made by the recognized foreign leaders without strong reasons, as it involved the discarding of much expensive equipment, the purchase and making of much new machinery and tools, and great loss in money and time due to the radical changing of methods.

Without waiting for public demand, European manufacturers have adopted real improvements in automobile construction, regardless of cost, earlier and to a much greater extent than American manufacturers, who oftentimes consider profit before merit.

The fact which best proves this assertion is that the Knight engine, invented in America by Charles Y. Knight, of Chicago, could find no favor with the American manufacturers until it had been adopted by the foremost foreign makers. Leading American manufacturers still doing a large and profitable business with poppet-valve engines naturally contest as long as possible the introduction of so radical and costly an improvement as the Knight engine.



Lyons-Knight Five-Passenger Sedan—\$3900

More than twenty thousand Knight cars are now in use. Some of these cars have run five hundred thousand miles, and have lost none of their quietness, smooth, positive action, power or great efficiency.

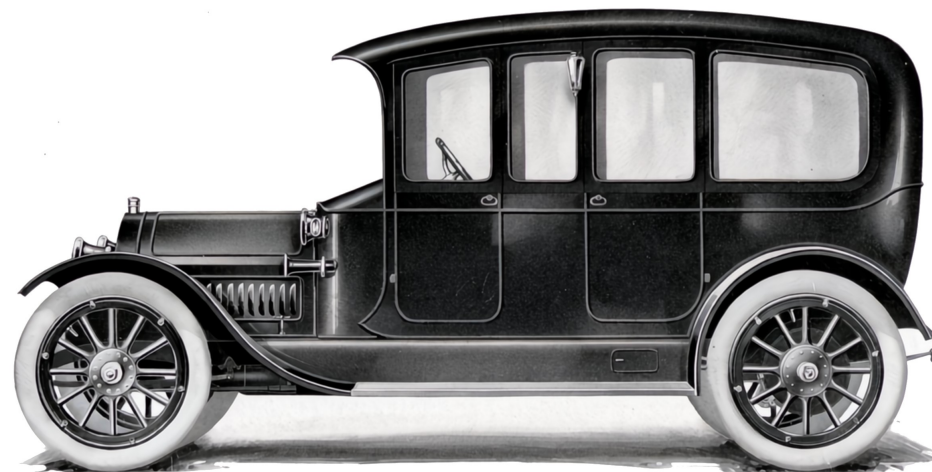
The Knight engine has obtained a notable prestige with the royalty and nobility of Europe, the majority of whom are now using cars equipped with Knight engines.

European companies have received very flattering testimonials regarding the highly successful performance of the Knight engine from the king of England, the emperor of Germany, the king of Belgium, the king of Sweden and others.

A remarkable acknowledgment of the merits of the Knight engine in this country is its endorsement and use by the people with the greatest automobile experience, and by those who are most familiar with the theory and requirements of an automobile engine.

The first achievement of the Knight engine, which brought it prominently to the public's attention, was the winning of the "Dewar trophy"—awarded by the Automobile Club of Great Britain, April, 1909, for the greatest achievement of the year in automobile engineering. The conditions and requirements of the test were so severe that no poppet-valve engine company could or would attempt it.

Two hundred and fifty omnibuses equipped with Knight engines have been delivered and two hundred and fifty more are being built for the Lon-



Lyons-Knight Seven-Passenger Berlin —\$4300

don omnibus service, after years of experience and testing with the best makes of poppet-valve engines.

The success of the Knight engine over poppet-valve engines in this London omnibus service has been much greater than the most optimistic prediction, the cost of maintenance being cut down enormously. The gasoline consumption is much less and the reliability of the service greatly increased.

Two cars equipped with Knight engines were first and second in the last Swedish Winter Race against sixty-six other competitors. A Knight car also won the last Ardennes Circuit Race in which the best foreign cars competed. Knight cars also made a clean sweep of a recent car competition in Germany.

The Knight engine, the same as other great inventions, has to make progress against the stiffest possible opposition of its established competitors, the wise ones knowing that when the public find out the real merit and great superiority of the Knight engine they will have to adopt it or quit.

This inevitable result they are trying to delay as long as possible, as it means radical changes and much expense to them. A great amount of prejudiced, foolish and ignorant statements are circulated about the Knight engine, and generally the people who talk the most against it are the ones who know the least about it. Naturally, this talk impresses people who have little knowledge of motor cars, but it has no effect on the broad-minded persons who study the facts and do their own reasoning. These are the people who are interested in and buying Knight cars.



THE LYONS-KNIGHT ENGINE

THE Lyons-Knight Model K cars are equipped with a four-cylinder, four-cycle $4\frac{1}{2}$ -in. bore by $5\frac{1}{2}$ -in. stroke Lyons-Knight engine. It is without doubt the best Knight engine in the world, as it is the latest designed, embodies all the best features of the European and American Knight engines, together with many desirable, new and exclusive improvements.

The principles of operation of the Lyons-Knight engine are the same as in all Knight engines.

Its distinctive features will be the future standard for all makers of Knight engines.

It has been carefully designed and tested by the best foreign and American engineers working in close conjunction with Mr. Knight and his corps of experts.

FEATURES

Relative to other Knight engines, its sleeve travel has been increased, which improves the sealing of the ports and increases the power. The sleeves have been designed with thicker walls, larger fillets and much stronger lugs at the bottom. This prevents any possibility of their springing out of round or breaking.

Its oiling system is much improved over other Knight engines, no splash oiling being used, as the oil is positively pumped to all the bearings, including the eccentric shaft and eccentric rod bearings. The oil is also pumped direct to the pistons and sleeves.

An adjustable pressure regulator is in the oil circuit. This regulator is connected with the throttle lever on the steering wheel, so that when the engine is throttled low a minimum pressure is on the oil system. When the throttle is opened the oil pressure instantly increases.

The oil pressure therefore varies with the power of the engine and not with the speed. This improved oiling system and regulation entirely removes a criticism of the Knight engine, and it also eliminates the smoking.

The Lyons-Knight engine excels all other Knight or poppet-valve engines in simplicity and neatness of design, in beauty of finish, in highest grade material and workmanship in every detail and in the ingenious accessibility of every part.



MATERIALS USED

The crank shaft, eccentric shaft and connecting rods are made of chrome nickel steel, heat treated. This is the best material procurable, as it has an enormous tensile strength and it withstands crystallization and fatigue through long severe usage to a greater extent than the cheaper steels.

The crank case, chain case and cylinder caps are aluminum. All other external surfaces are either black enamel or heavily nickel-plated. The entire top of each pair of cylinders, including spark plugs and wires is covered with a polished aluminum cap, keeping these parts clean and giving a very finished appearance. In this cap hard rubber buttons are mounted, by means of which the spark plugs may be tested without removing the cap.

The cylinders, pistons, sleeves and heads are all cast in our own foundries from a special mixture of cast iron, which has proved the best adapted for these parts. Careful tests have proved that this special mixture of cast iron is superior to the best foreign mixtures.

PORT ARRANGEMENT

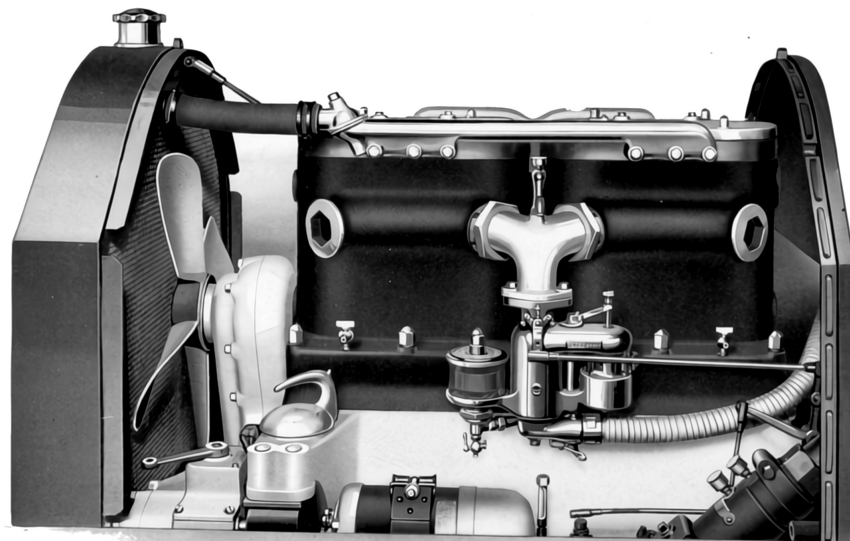
The inlet ports are so arranged in the cylinders that the shortest possible carburetor manifold is required, giving minimum amount of fuel condensation. The exhaust manifold is so designed that no back pressure is possible in any cylinder. It is 3 inches in diameter at the exhaust pipe connection.

HORSEPOWER

This engine delivers fifty brake horsepower at twelve hundred revolutions. The engine may be speeded up much higher, developing up to seventy horsepower. The power developed in a Lyons-Knight engine is at all speeds in excess of that developed in a poppet-valve engine of equal sized cylinders. At high speeds the power developed is far in excess of the poppet-valve engines.

The Lyons-Knight engine increases in power and gasoline efficiency up to 50,000 miles running, as the sleeves then get sufficiently polished to give maximum compression and the least friction. From that time on through many years of service there is no loss of power or efficiency and no increase in noise.

The best type of poppet-valve engines will show their maximum power only to about 20,000 miles running. From there to the end of their short useful life they steadily lose their power and the gasoline consumption increases, because the large valves and valve seats now used gradually warp out



Carburetor and Starter Side of Lyons-Knight Engine

of shape, due to the intense heat, pressure and pounding action, and lose their accuracy and tightness, which no regrinding can completely remedy. The noise constantly increases, due to the wear of the poppet valve mechanism.

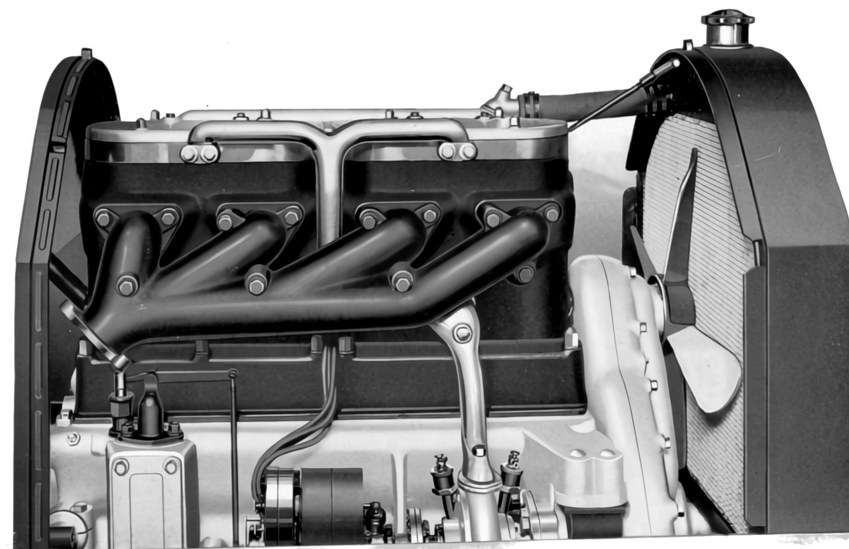
In the Lyons-Knight engine 20 per cent. more of the heat of combustion is converted into power than in a poppet-valve engine. This means less heat and power lost through the cylinder walls into the water, as in this engine the spherical combustion chamber exposes 20 per cent. less surface to cool and reduce the combustion pressure.

SLEEVES

The two sliding sleeves of this engine are non-adjustable, positive and noiseless in operation, giving no trouble and showing no perceptible wear in many years of service. They are made from a special mixture of dense cast iron, having a very high tensile strength.

CRANK SHAFT

The crank shaft has five large main bearings fitted with adjustable bronze bushings, babbitt lined. They are made adjustable by the use of different



Exhaust and Magneto Side of Lyons-Knight Engine

thicknesses of shims, so that any wear can be readily taken up. The four crank pin bearings are adjustable in the same manner.

COOLING

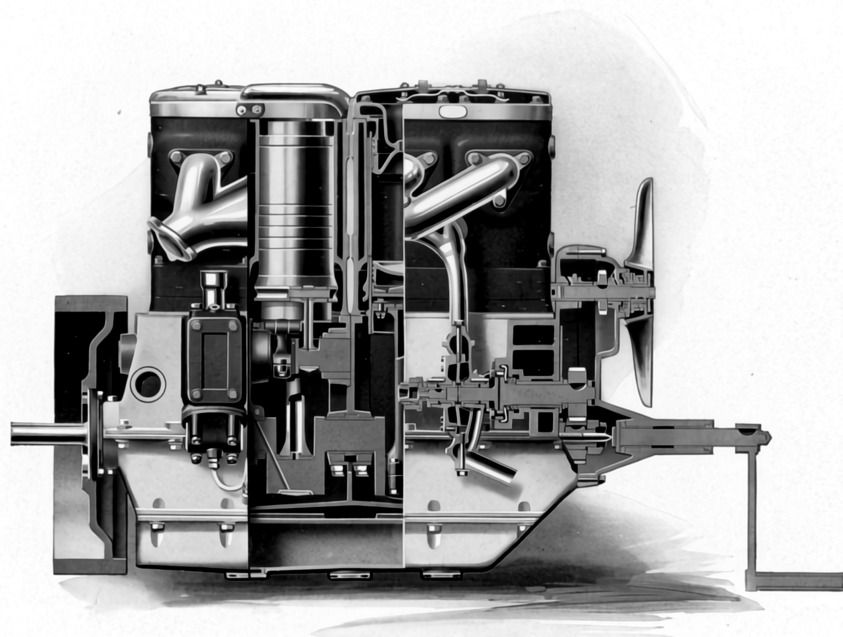
The engine is water cooled with centrifugal pump and cellular radiator.

SILENT CHAIN DRIVE

The fan shaft, together with the pump, magneto and eccentric shaft, are all driven, with ample-sized silent chains. An adjustable idler maintains the proper chain tension. The chains are enclosed in an aluminum case and are abundantly lubricated on the inside or working face by a constant stream of oil from the main oil pump.

OILING SYSTEM

The oil reservoir is formed by a sub-base underneath the crank case, with an intermediate air space, which prevents the undue heating of the oil. A force-feed plunger pump, operated by one of the sleeve eccentric-rods takes the oil



Showing Section of Engine Details

from the reservoir and forces it to all the crank shaft bearings, eccentric shaft bearings and eccentric rod bearings.

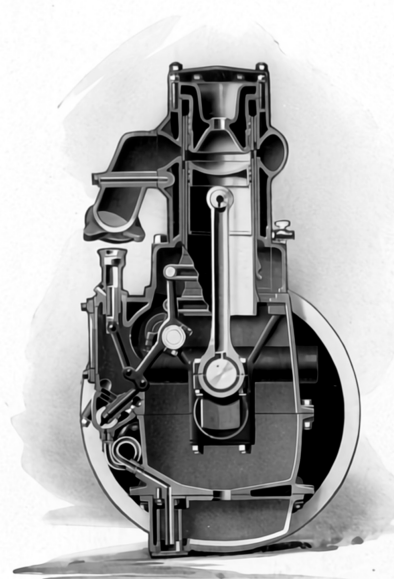
It also oils the lower connecting rod bearings through drilled holes in the center of the crank shaft. The oil is then forced up through the hollow connecting rods to their upper bearings, then through the hollow piston pins to the outside of the piston, amply and evenly lubricating the pistons.

Holes through the inner sleeve conduct the oil to and lubricate the sleeves and cylinder walls. An indicator on the side of the oil reservoir shows the amount of oil; an adjustable oil pressure regulator is connected with the throttle lever.

The oil pump is positive in action, having no check valves, and the oil is thoroughly strained when it returns to the reservoir.

CARBURETOR

The double jet carburetor used has been especially designed for Knight engines—one jet supplies gas for starting and for slow speeds and the second or



Engine Cross Section

auxiliary jet comes into service automatically for the intermediate and higher speeds.

The auxiliary air is automatically regulated by an improved method which keeps the quality of the mixture exactly right under all conditions.

The carburetor is located high up near the inlet port, making it easy to adjust and inspect. It has a hot-water jacket and hot air is conducted to it through a flexible metal tube from a fitting on the exhaust pipe. A lever on the steering column regulates the air at the carburetor.

IGNITION

A dual high-tensioned magneto furnishes ignition. It is of the waterproof type and is so designed that it gives as powerful a spark in the retarded position as in the advance position. The car can be slowed down

on the high speed to five miles an hour and spark regularly on the magneto.

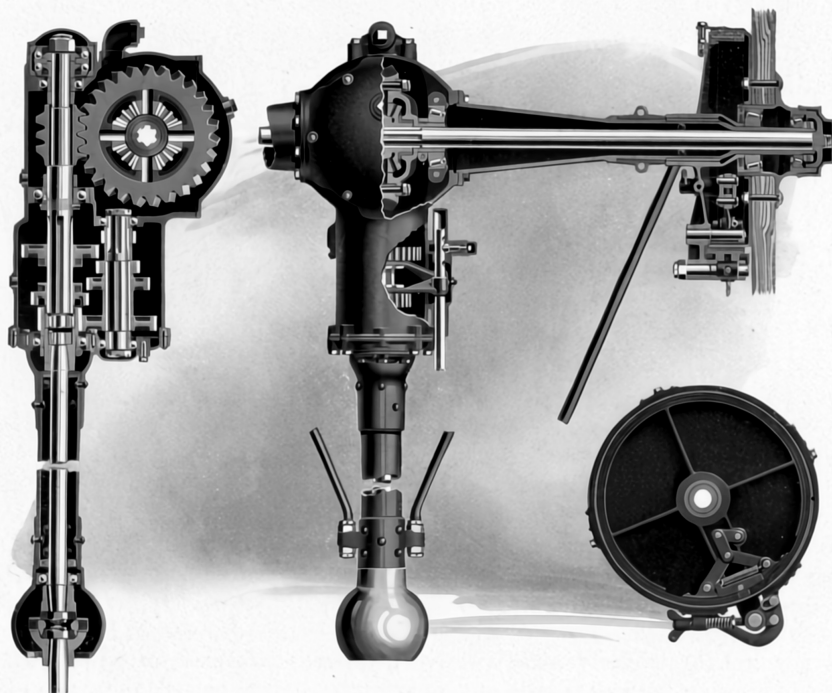
ELECTRIC STARTER AND LIGHTING

The electric starting motor and generator is combined in one unit. It is very simple and compact, light in weight and silent in its action. It will readily and positively start the engine in the coldest weather, as it has a remarkable torque pull and spins the engine at a high rate of speed, which gives a quick and positive starting of the engine and eliminates the need of an engine primer. The electric starter is very efficient. It uses the minimum amount of current, thereby saving the abuse of an excessive discharge, which other starters give to the battery. There is no shifting of gears and the starting is accomplished by simply pushing a button. After the engine is started, the motor acts as a generator and charges the storage battery, the rate being properly controlled electrically, instead of by the delicate and uncertain mechanical regulators in common use. This accurate and positive regulation of the charging current is necessary to keep the storage battery fully charged at all times and in a proper condition and eliminates battery troubles. The storage battery furnishes current for electric starting, also for the complete lighting equipment and electric horn.



LYONS-KNIGHT FOUR-CYLINDER EQUAL TO POPPET-VALVE SIX-CYLINDER

One great advantage and important fact is that a four-cylinder Lyons-Knight engine is equal to the best six-cylinder poppet-valve engine in power, control and smooth, non-vibrating running and is much superior in fuel economy, silence, reliability and lasting qualities. A six-cylinder engine costs more, weighs more, requires more space, uses much more fuel, has many more parts to break, wear, adjust and make noise and trouble. If Lyons-Knight four-cylinder cars had been in use earlier, six cylinders would never have been necessary or popular.



Cross Section Views of Lyons-Knight Rear Axle System



LYONS-KNIGHT MODEL K CARS

THE chassis and wheelbase of the Model K cars are all similar, except the rear springs, which are heavier on the six and seven-passenger cars. The six and seven-passenger bodies, however, are eight inches longer than the four and five-passenger bodies. They have 8 inches overhang of the rear axle. The five and seven-passenger bodies are standard, but the four and six-passenger bodies are special and have to be built to order. A smaller Lyons-Knight engine is being built which will be put in high-class Lyons-Knight roadsters, runabouts, town cars and a small five-passenger touring car.

The Model K cars have three forward speeds and are geared 3½ to 1. They will give a wonderful performance on the high gear, due to the remarkable power and flexibility of the Lyons-Knight engine and the proper gear ratio. On the high gear they can be run from four to sixty miles an hour without mechanical noise or vibration, can climb hills at any speed desired from six to forty miles, easily start from a stand-still and will accelerate rapidly. If a four-speed transmission were used, these advantages on high gear would be much less, as the fourth speed would naturally be geared higher, which would handicap the engine and require frequent shifting of the gears.

A Lyons-Knight car will perform much better with a three-speed transmission than the best poppet-valve cars with four speeds. Cars with poppet-valve engines are geared as high as possible to give low engine speeds, as the mechanical noise and vibration increase directly with the engine speed. This is not so with the Lyons-Knight engines.

The Lyons-Knight cars are so constructed that they will easily turn around in a 40-foot circle or in an ordinary-width street. They are balanced to give the smoothest and safest possible riding over rough roads and at high speeds, if necessary.

Skidding and swaying is reduced to a minimum, even when turning sharply at the side of the road. This is accomplished by the proper distribution of weight, the method of attaching and driving the rear axle, also the action of the hydraulic shock absorber, one of which is attached from the center of the rear frame-member to the worm gear casing. There is no check on the downward motion of the body or compression of the springs, but all the checking and regulating action is on the upward rebound, which prevents the jolting of the passengers and breakage of springs.

Wood wheels are furnished as regular equipment because of their neater appearance and less liability of getting damaged. Wire wheels will be fur-



nished at an extra charge, if desired, but the wire spokes are much more likely to get bent and broken from the stones and curbing, get out of true, loosen up and rattle.

The 50 per cent. more mileage claimed with wire wheels is a fallacy when cars are used at ordinary speeds with proper size tires. For extreme strength, with minimum weight and size, and where much tire heat is generated, as in races, the wire wheels have advantages.

CLUTCH

The clutch is of the three-plate type enclosed in the flywheel. The single center steel floating member is large in diameter, also thin and very light to give maximum friction surface with minimum weight. It is engaged by being gradually compressed between the two outside plates through the action of three very powerful toggle joints. The center plate is faced with raybestos. This clutch is very powerful, engages in the smoothest possible manner, can be easily adjusted, requires only a light spring to operate it and has a short throw of the clutch pedal. It releases positively, does not drag, has no end thrust and can be slipped if necessary without jerk or chatter.

TRANSMISSION

The transmission is of the selective three-speed sliding gear-type. It is embodied in the rear axle housing. This removes the transmission from the frame and body of the car to the rear axle, eliminating to a great extent its noise and vibration; also eliminating the heavy strains on the universal joints.

WORM DRIVE

The worm drive gear has been adopted because of its great success and popularity in the best makes of foreign cars and because of its many demonstrated advantages over the bevel gear drive. It is absolutely silent under all conditions, increases in efficiency with use rather than decreasing, as with bevel gears. It does not become noisy with use like the bevel gears. It is much smoother in operation and drives the car much more evenly, without the slightest vibration or roughness, which is often noted with the bevel drive. It is much stronger, as large teeth can be used and the work is distributed over several teeth and over much more surface than the bevel gear, where the work is largely done by one small tooth. Bevel gears with sufficiently large teeth can not be used on account of the noise they would make.

With the worm gear the different gear ratios can be easily obtained without distorting the size of the gears that is necessary with bevels. When new,



the worm and bevel gear are about equally efficient. With continued use the worm increases in efficiency and the bevel decreases in efficiency, as the worm gear gains more bearing surface, gets smoother and reduces its friction, while the bevel gear wears out of pitch and increases its friction. The worm is on the under side, which gives the best lubrication and proper clearance from the floor of the body. The ground clearance under the worm is 10 inches. The case is round at this point and inclines upward to the front end with a 12-inch clearance. No lugs are on the bottom and the case will slide over rocks 12 inches high with no damage.

REAR AXLE

The rear axle is of the full-floating type; the axle housing is of special bronze; the extensions on which the wheels are mounted are tapered, seamless, drawn steel tubing. The two driving shafts and all of the differential and transmission gears are made of special alloy steel, properly heat treated and hardened. The transmission shaft and worm shaft are equipped with the best annular ball bearings. The differential case and the rear wheels are mounted on extra large Timken adjustable roller bearings. A 3-inch tube acts as a torsion tube and drag tube and is rigidly connected to the front end of the rear axle housing. It encloses the drive shaft and terminates forward in a large hollow ball and socket joint which is attached to the central cross-member of the frame. It has been fully demonstrated that this construction gives the steadiest, safest, smoothest and strongest drive to the car, and by always keeping the two axles parallel eliminates any tendency to swerve at high speeds, or when going over rough roads, which is the tendency of many cars that drive through the front end of the rear springs.

UNIVERSAL JOINTS

The angularity between the engine shaft and the rear axle is equally divided between the two large Spicer universal joints, making the angularity at each joint very slight, and the two joints are set so that the second one perfectly corrects the error which always occurs when only one universal joint is used. This gives the effect of a straight line drive without the disadvantages of setting the engine on an incline.

FRONT AXLE

The front axle is the latest Timken design. It has a drop forged I-beam center section and the front hubs and steering heads are all equipped with large adjustable Timken roller bearings.



BRAKES

Two sets of double-acting brakes apply directly on the rear wheels on 16-inch brake drums. The foot or running brakes are external bands $2\frac{1}{2}$ inches wide, lined with raybestos, and the bands are tightened by powerful levers so designed that a full wind-on action may be applied to the brake drums with the car running in either direction. This arrangement gives the maximum braking effect with the minimum foot pressure. The hand or emergency brakes are internal split steel rings $2\frac{1}{2}$ inches wide covered with raybestos. They are also arranged to act with equal power with the car running in either direction. Both sets of brakes are very powerful and smooth-acting and are easily and quickly adjusted without tools.

SPRINGS

The rear springs are three-quarter elliptic, 54 in. long by $2\frac{1}{2}$ in. wide, made from special alloy steel. They are swiveled on the axle and are shackled at both ends. They, therefore, take none of the driving, and all their action is concentrated in giving the greatest possible flexibility and ease of riding.

The front springs are half elliptic, 38 in. long by $2\frac{1}{2}$ in. wide. They are designed very flat, so that in action they hold the front axle at all times parallel with the rear axle, and their front ends work exactly in unison with the steering connection, so that all wobbling of the front wheels over rough roads is prevented. Compression grease cups lubricate all spring shackle bearings. The spring shackles are in one piece, with extra wide bearings, and have lugs to prevent reversing. All spring bolts are hardened and ground and the ends of the springs are bronzed bushed.

FRAME

The frame is pressed steel, channel section, 5 inches deep and 4 inches wide in the center. A 6-inch drop at the rear gives ample clearance over the rear axle.

STEERING GEAR

The steering gear is the highest grade irreversible type, mounted on the left-hand side of the car. The wheel is corrugated hard rubber 18 inches in diameter. A supplementary bracket half way up the large column and attached to the dash gives great rigidity to the wheel. The shafts in the steering gear housing are hardened and ground steel and the bearings are all bronze bushed. All of the bearings of the steering connections have hardened and ground bushings and studs.



CONTROL AND DASH ARRANGEMENT

The gear shift and emergency brake levers are placed in the center; the gear shift lever is short, close to the seat, works in an H slot with small amount of motion. The driver can enter the car from either side with equal facility. The throttle and spark control levers are mounted on top of the steering wheel. The carburetor adjustment is on the steering column. The gasoline shut-off valve and gasoline reserve valve are mounted on the dash within reach of the driver. A foot accelerator is mounted on the toe board. The electric starter is controlled by a push button on the dash and all the electric light switches are mounted on the dash. The speedometer and clock are mounted flush on the dash, also a gasoline gauge and a pressure oil gauge. A dash lamp lights up all the instruments at night.

WHEELBASE AND TREAD

The wheelbase of both the five and seven-passenger cars is 130 inches and the tread is 56 inches.

RIMS AND TIRES

Quick detachable, demountable rims with 37 by 5 inch Goodyear tires are the standard equipment. Smooth treads are furnished for front with non-skids on the rear.

GASOLINE TANK

The gasoline tank, conforming to the latest European practice, is located in the upper part of the dash, over the toe board. This location does not interfere with the foot room and gives a short, direct gravity feed to the carburetor. It holds twenty-two gallons—two gallons being in reserve.

BODIES

The body being the most conspicuous feature of the car and its proper design so essential to style and comfort, no expense has been spared to have it right in every detail and in appearance. All Lyons-Knight bodies are made of sheet aluminum, giving a strong, light, indestructible body, which takes a beautiful finish and is easily cared for. They are exceptionally roomy, with high sides and with deep, soft Turkish cushions. The rear seats of the five and seven-passenger cars are 52 inches wide. The best hand-buffed leather and black horse-hair are used for the upholstery. The Berlin and Sedan bodies are very exclusive in design, appearance and finish, and they are trimmed and painted to order.



The standard color of the touring cars is dark blue and dark Brewster green, and the standard upholstery is bright or dull-finished hand-buffed leather, black in color.

TOP

The very desirable Golde patent one-man top, equipped with Collins patent curtains, is furnished as regular equipment. This top can be easily raised and lowered by one person, as it has no attachment to the side of the front seat, but attaches at the front to the top of the windshield. It has no adjustable bows to interfere when getting in and out of the front seat. The standard top material is genuine black pantasote, as experience has demonstrated that this is a better and more serviceable material than the silk mohairs.

WINDSHIELD AND VENTILATOR COMBINED

The windshield is of our own design and make. There are two adjustable plate-glass sections, the wide one above and a narrow one below. The lower part of the top glass swings out for the rain vision. The lower part of the bottom glass swings in, forming an adjustable ventilator across the entire top of the glass.

EQUIPMENT

The standard equipment, in addition to the top, dust cover and windshield, includes a Warner speedometer, clock and gasoline gauge mounted flush in the dash, combination tire holder and trunk rack on the rear to carry two extra tires, the two extra demountable rims being furnished, coat and foot rails, cocoa matting for the tonneau, complete tool and tire outfit, complete electric light equipment, including an electric light to illuminate the dash and a trouble hand lamp, large storage battery, two-tone electric horn, a slight pressure of the electric button giving a moderate tone for city use and an increased pressure giving a maximum sound for country use. All equipments and metal trimmings of the car are either black enamel or heavily nickel plated. The storage battery and tools are carried under the front seat. The running boards are clear.

Five-Passenger Touring Car with Standard Equipment	.	.	.	\$2,900
Seven-Passenger Touring Car with Standard Equipment	.	.	.	2,980
Sedan Five-Passenger Car with Standard Equipment	.	.	.	3,900
Berlin Seven-Passenger Car with Standard Equipment	.	.	.	4,300

All Cars are Sold F. O. B., Indianapolis

